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Date of Application : February 21, 2001

Application Number : Japanese Patent Application No. 2001-044884

Applicant(s): DENSO CORPORATION

November 30, 2001

Commissioner,
Japan Patent Office Kozo Oikawa

Certificate Issuance No. 2001-3104808

[Name of Document] Patent Application
[Reference Number] PY20002864
[Filing Date] February 21, 2001
[Address] Commissioner of Patent Office
[International Patent Classification] H05K 5/00
[Inventor]
[Address] c/o DENSO CORPORATION
1-1 SHOWA-CHO, KARIYA-CITY, AICHI-PREF.
[Name] Toshiki Kobayashi
[Inventor]
[Address] c/o DENSO CORPORATION
1-1 SHOWA-CHO, KARIYA-CITY, AICHI-PREF.
[Name] Hajime Katsuro
[Inventor]
[Address] c/o DENSO CORPORATION
1-1 SHOWA-CHO, KARIYA-CITY, AICHI-PREF.
[Name] Yukihiro Kato
[Inventor]
[Address] c/o DENSO CORPORATION
1-1 SHOWA-CHO, KARIYA-CITY, AICHI-PREF.
[Name] Toshio Fujimura
[Applicant]
[Identification Number] 000004260
[Name] DENSO CORPORATION
[Agent]
[Identification Number] 100068755
[Patent Attorney]
[Name] Hironobu Onda
[Selected Agent]

[Identification Number]	100105957	
[Patent Attorney]		
[Name]	Makoto Onda	
[Indication of fees]		
[Prepayment Book Number]	002956	
[Amount of Payment]	21000	
[List of Submitted Articles]		
[Name of Article]	Specification	1
[Name of Article]	Drawings	1
[Name of Article]	Abstract	1
[General Power of Attorney Number]	9908214	
[Need of Proof]	Needed	

[Type of Document] Specification

[Title of the Invention] Electronic Control Unit and Its Conveyance System

[Claims]

[Claim 1] An electronic control unit, having a case wherein at least a bottom surface opens, and an approximately plate-shaped cover which closes a case opening in a state where a circuit board is contained in the case, said electronic control unit being arrayed and conveyed on a conveyer passage of an automated assembly line,

wherein a stay projecting from a side surface of said case is integrally formed with said cover, and an end of the stay is bent as a bent portion.

[Claim 2] The electronic control unit according to claim 1, wherein assuming that the thickness of said electronic control unit is W, the width of the conveyer passage is L and the height of the bent portion is H, the height H of the bent portion is defined such that "H>L-W" holds.

[Claim 3] The electronic control unit according to claim 1 or 2, wherein said cover is provided with a pedestal for placing said circuit board in a position higher from a bottom plate by space for containing said circuit board, and wherein the height of the bent portion is defined so as to be equal to or lower than the height of the pedestal.

[Claim 4] The electronic control unit according to any one of claims 1 to 3, wherein a first rib is formed in said stay in approximately the same direction as that in which said stay extends.

[Claim 5] The electronic control unit according to claim 4, wherein in said cover, a second rib is formed in the bottom plate positioned in the case.

[Claim 6] A conveyance system for conveying the electronic control unit according to any one of claims 1 to 5, wherein electronic control units are sequentially conveyed on the conveyer passage such that stays of adjacent electronic control units face each other.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to an electronic control unit mounted on an automotive vehicle or the like and its conveyance system, and more particularly, to a casing structure for electronic control unit to solve various types of inconvenience upon line conveyance.

[0002]

[Prior Art]

An electronic control device such as an engine ECU (electronic control unit) is mounted in an automotive vehicle which performs various electronic controls, and in the electronic control unit, a circuit board is contained in accommodation space formed by case and cover.

Further, the electronic control unit is attached to the automotive vehicle by using a bracket. In this case, a stay is integrally formed with the cover, and the stay itself is used as a bracket, otherwise, another bracket member is attached to the stay after the electronic control unit has been assembled.

[0003]

Fig. 6 is an exploded perspective view for explanation of conventional structure of the electronic control unit (ECU). As shown in Fig. 6, an ECU 50 has a case 51, a circuit board 52 and a cover 53, and the respective members are assembled by fastening by screws 54. The cover 53 is provided with stays 55 projecting outward from case side surfaces. The stays 55 have screw holes 56 in e.g. 2 positions. Then the ECU 50 is attached to the automotive vehicle via the stays 55. In this case, it may be determined whether the stay 55 itself is used as a bracket or another bracket member is used, based on a factor such as an attachment position on the vehicle side. Note that generally, the stays 55 are provided on both opposed side surfaces due to balance of the ECU 50 on the vehicle.

[0004]

[Problems to Be Solved by the Invention]

In an automated vehicle assembly line, ECUs are arrayed on a conveyer passage and sequentially conveyed, and they are chucked by a robot or the like and

transferred to the next process in accordance with necessity. In this case, the ECU is conveyed in a state where it stand on the conveyer passage (one side surface of the case is faced down) or in a state where it lies (the cover is faced down). In an assembly line for conveying the ECUs in a state where they stand, to smoothly convey the ECUs on the conveyer passage, it is necessary to set appropriate space between sidewalls of the conveyer passage (passage sidewalls) and the ECUs. That is, if the space between the passage sidewalls and the ECU is too large, the ECUs may lean and fall down, or the orientation of the ECUs may be greatly shifted from a traveling direction and may cause chuck failure by the robot. On the other hand, if the space between the passage sidewalls and the ECUs is too small, the ECUs contact the passage sidewalls and may be chipped by friction, which may cause inconvenience such as stoppage of operation.

[0005]

Particularly, as the ECU 50 described in Fig. 6 has stays 55 in the cover 53, when the ECU 50 is conveyed on the conveyer passage, the stays 55 of the before and after ECUs 50 may overlap with each other. That is, in the conveyer passage 60 as shown in Fig. 7, a conveyer 61 flows at a predetermined speed by a roller or the like, and a large number of ECUs 50 in upright position are conveyed between passage sidewalls 62 provided left and

right to the conveyance direction. In this case, the respective stays 55 of before and after ECUs 50 face each other, and if the space between the ECUs 50 is reduced, the stays 55 overlap with each other. This causes the ECUs 50 contact the passage sidewalls 62 and stops them within the conveyer passage 60.

[0006]

Further, in an assembly line for conveying the ECUs 50 in flat state, as in the case of the conveyance of the ECUs 50 in upright state, the stays of before and after ECUs 50 may overlap with each other and cause the same inconvenience.

[0007]

The present invention has been made in view of the above problem, and has its object to provide an electronic control unit which prevents various types of inconvenience upon conveyance and improves productivity.

[0008]

[Means to Solve the Problems]

In the electronic control unit described in claim 1, the stay projecting from the side surface of the case is integrally formed with the cover, and the end of the stay is bent as a bent portion. By this arrangement, when the electronic control units are arrayed and conveyed on the conveyer passage of automated assembly line, the overlap between stays of adjacent electronic control units can be prevented. That is, regarding adjacent electronic

control units, even if they contact each other, bent portions at the end of the stays merely abut each other but the stays do not overlap with each other. Accordingly, various types of inconvenience upon conveyance can be prevented and productivity can be improved.

[0009]

It is preferable that the height of said stay is defined as in claim 2 or 3. That is, as described in claim 2, assuming that the thickness of said electronic control unit is W, the width of the conveyer passage is L and the height of the bent portion is H, the height H of the bent portion is defined such that "H>L-W" holds. In this case, the dimension L-W is the dimension of space between the electronic control unit placed on the conveyer passage and the passage sidewall. If the height H of the bent portion is greater than the dimension L-W, the overlap between the bent portions of adjacent electronic control units can be reliably prevented.

[0010]

Further, as described in claim 3, the height of the bent portion is defined so as to be equal to or lower than the height of the pedestal of the cover. If the height of the bent portion is defined in this manner, when a number of covers are stacked before assembly in the process of manufacturing the electronic control unit, the bent portions of the covers do not become nuisance of

stacking. Accordingly, operability can be improved.

[0011]

In the invention described in claim 4, the first rib is formed in the stay of the cover in approximately the same direction as that in which the stay extends. By this arrangement, the strength of the stay is improved. Accordingly, when the ECU is mounted on an automotive vehicle or the like where a high level of vibration is caused, the unit can be provided with sufficient vibration-resistance and distortion-resistance strength.

[0012]

Further, in the invention described in claim 5, in the cover, the second rib is formed in the bottom plate positioned in the case. By this arrangement, even the strength of the bottom plate of the cover is improved. In this case, it is preferable that the second rib is provided so as to intersect the first rib.

[0013]

Further, as a conveyance system, as described in claim 6, it is preferable that the electronic control units are sequentially conveyed on the conveyer passage such that the stays of adjacent electronic control units face each other. By this arrangement, an excellent conveyance system can be constructed.

[0014]

[Working Examples]

Hereinbelow, a working example embodying the

present invention will be described with reference to the drawings. Fig. 1 is a perspective view showing the entire structure of ECU 10. Fig. 2 is an exploded perspective view showing principal constituents of the ECU 10 in an exploded manner.

[0015]

In these Figs. 1 and 2, the ECU 10 has a case 11 in which a bottom surface opens, a circuit board 13 with which a connector 12 is integrated and an approximately plate-shaped cover 14 to close the opening of the case 11, and these respective members are assembled by fastening by screws 15. For example, the case 11 and the cover 14 are formed by press working using an iron plate, an aluminum plate or the like. Note that in the present working example, the front/rear/up/down directions of the ECU 10 are defined based on the states in Figs. 1 and 2 for the sake of convenience, and in the case 11, the side where a connector 12 is exposed is a front surface, and its opposite side is a rear surface.

[0016]

Next, the constructions of the case 11 and the cover 14 will be described in detail. First, in the case 11, a connector exposure portion 21a is provided on one side surface, and sidewalls 21b, 21c and 21d are provided on the other three side surfaces. Among the sidewalls 21b to 21d, the left and right sidewalls 21b and 21c are tapered and the rear sidewall 21d is provided upright. A

flat pedestal 22 surrounding the case opening is provided below the sidewalls 21b to 21d, and a fringe of the circuit board 13 is placed on the lower surface of the pedestal 22. Further, a guide member 23 slightly greater than the outer dimension of the circuit board 13 is provided on the periphery of the pedestal 22. Comparatively low and cylindrical nuts 24 are embedded in an upper surface of the pedestal 22 at the corners of the case 11.

[0017]

On the other hand, the cover 14 has approximately the same outer dimension as that of the circuit board, and has a bottom plate 31, and a pedestal 32 provided on the periphery of the bottom plate 31. In this case, the pedestal 32 is provided in a position higher from the bottom plate 31 by space containing the circuit board 13, and the flange of the circuit board 13 is placed on the pedestal 32. That is, when the ECU 10 is assembled, the circuit board 13 is fixed with its flange held between the pedestal 22 of the case 11 and the pedestal 32 of the cover 14.

[0018]

Further, a pair of stays 33 projecting outside from the case 11 are integrally formed with the cover 14, and the stays 33 are provided with mounting holes 34 for mounting a bracket (not shown). In this case, the ECU 10 is mounted on the automotive vehicle via the brackets

mounted on the stays 33. Note that since the bracket does not disturb conveyance and the specification of the stay 33 can be unified regardless of various brackets for car models, there are merits of previously providing the stays 33 in the cover 14 and attaching another bracket later. Note that it may be arranged such that the stays 33 themselves are used as a bracket and the ECU 10 is directly mounted on the automotive vehicle by using the mounting holes 34.

[0019]

Further, the end of the stay 33 is bent thus a bent portion 35 is formed. The height of the bent portion 35 may be determined in correspondence with the dimension of space between the conveyer passage sidewalls in the automated assembly line and the ECU 10. More specifically, as shown in Fig. 3, assuming that the thickness of the ECU 10 is W, the width of the conveyer passage is L, and the height of the bent portion 35 is H, the minimum height H of the bent portion 35 is defined such that "H>L-W" holds. Note that in this case, space $\delta 1$ and $\delta 2$ are ensured between the ECU 10 and the conveyer passage, and the height H of the bent portion 35 may be defined such that "$H > \delta 1+\delta 2$" holds.

[0020]

Returning to Figs. 1 and 2, in the cover 14, a first rib 36 is provided at the center of the stay 33, and a second rib 37 is provided on left and right edges

of the bottom plate 31. The first rib 36 is provided in approximately the same direction as that in which the stay 33 extends, and the second rib 37 is provided so as to extend along the sidewalls 21b and 21c of the case 11. The first and second ribs 36 and 37 have an upwardly-convex semispherical or triangular cross section, and the respective ribs intersect at right angles at the center of the second rib 37.

[0021]

In this case, as the first rib 36 extends from the outside to inside of the case 11, a concave portion 25 corresponding to the rib shape is provided in a position to abut the first rib 36. By this arrangement, when the cover 14 is attached to the case 11, positioning of these members can be easily and precisely made by putting the concave portion 25 and the first rib 36 together. Accordingly, the operability of attachment can be improved.

[0022]

Fig. 4 is a schematic perspective view showing conveyance of the ECUs 10 arrayed on the conveyer passage in the automated assembly line. Note that in Fig. 4, the shape and the like of the stay 33 are different from these in Figs. 1 and 2, however, differences are shown for the sake of convenience of explanation.

[0023]

As shown in Fig. 4, a conveyer passage 40 has a

conveyer 41 fed at a predetermined speed by a roller or the like and passage sidewalls 42 provided left and right to the conveyance direction. A large number of the ECUs 10 in upright state are conveyed on the conveyer 41. In this case, the ECUs 10 are arrayed with the sidewall 21d of the case (upright surface) faced down. Further, in before and after ECUs 10, the respective stays 33 face each other, and if space between the ECUs 10 is reduced, the bent portions 35 at the ends of the stays 33 abut each other. That is, even if the space between and after ECUs 10 is reduced, the stays 33 do not overlap with each other.

[0024]

According to the present working example as described above in detail, the following effects are obtained.

As the bent portion 35 is provided at the end of the stay 33, upon conveyance of the ECU 10, overlap between the stays 33 of adjacent ECUs 10 can be prevented. Accordingly, various types of inconvenience, including a problem that the ECUs 10 contact the passage sidewalls and stop in the conveyer passage or cause chuck failure by a robot, can be solved, and the productivity can be improved. By extension, an excellent ECU conveyance system can be constructed.

[0025]

Further, as the bent portion 35 is provided in the

stay 33, the strength of the stay 33 itself can be increased. Further, in the present working example, as the first rib 36 is formed in the stay 33 and the second rib 37 is formed in the bottom plate 31, the strength of the entire cover including the stay 33 is improved. Accordingly, in a case where the ECU is mounted on an automotive vehicle where a high level of vibration is caused, the unit can be provided with sufficient vibration-resistance and distortion-resistance strength.

[0026]

Note that the present invention can be embodied in the following example other than the above example.

In the above working example, the minimum height H of the bent portion 35 is defined as "H>L-W", however, a maximum dimension in addition to the minimum height may be defined. That is, at the ECU assembly process, as a large number of covers 14 are stacked in up and down directions, if the height H of the bent portion 35 is too large, it may be nuisance of stacking. Accordingly, the maximum dimension of the height H is defined as follows. More particularly, as shown in Fig. 5, assuming that the height of the pedestal 32 is Ha, the maximum height H of the bent portion 35 is defined such that "$H \leq Ha$" holds. By this arrangement, when a large number of covers 14 are stacked, the bent portion 35 does not disturb stacking. That is, a desirable range of the height H of the bent portion 35 is "$L-W<H \leq Ha$". If the bent portion 35 is bent

at a blunt angle, as the bent portion 35 does not disturb stacking, the above definition of maximum dimension may be removed.

[0027]

In the above working example, the ECU 10 is conveyed in upright state, however, in the case where the ECU 10 is conveyed in a flat state, similar effects can be obtained. That is, in a case where the ECU 10 is set in flat state, the stays of before and after ECUs overlap and cause inconvenience such as chuck failure by robot, however, the various types of inconvenience can be solved by providing the bent portion 35 in the stay 33 as described above.

[0028]

In the above working example, the first rib 36 is formed in the stay 33 of the cover 14 and the second rib 37 is formed in the bottom plate 31. However, as these first and second ribs 36 and 37 are not the subject matter of the present invention, the ECU can be realized by using only one of these ribs or non of these ribs.

[Brief Explanation of the Drawings]

[Fig. 1] A perspective view showing the structure of the ECU in the working example of the present invention.

[Fig. 2] An exploded perspective view of the ECU.

[Fig. 3] A top plan view showing the status of conveyance of the ECU.

[Fig. 4] A perspective view showing the status of conveyance of the ECU.

[Fig. 5] A front view showing the status where the covers are stacked.

[Fig. 6] An exploded perspective view showing the structure of the ECU in the conventional art.

[Fig. 7] A perspective view showing the status of conveyance of the ECU.

[Explanation of Reference Numerals]

10 ... ECU (electronic control unit), 11 ... case, 13 ... circuit board, 14 ... cover, 31 ... bottom plate, 32 ... pedestal, 33 ... stay, 35 ... bent portion, 36 ... first rib, 37 ... second rib, 40 ... conveyer passage.

[Type of Document] Abstract

[Abstract]

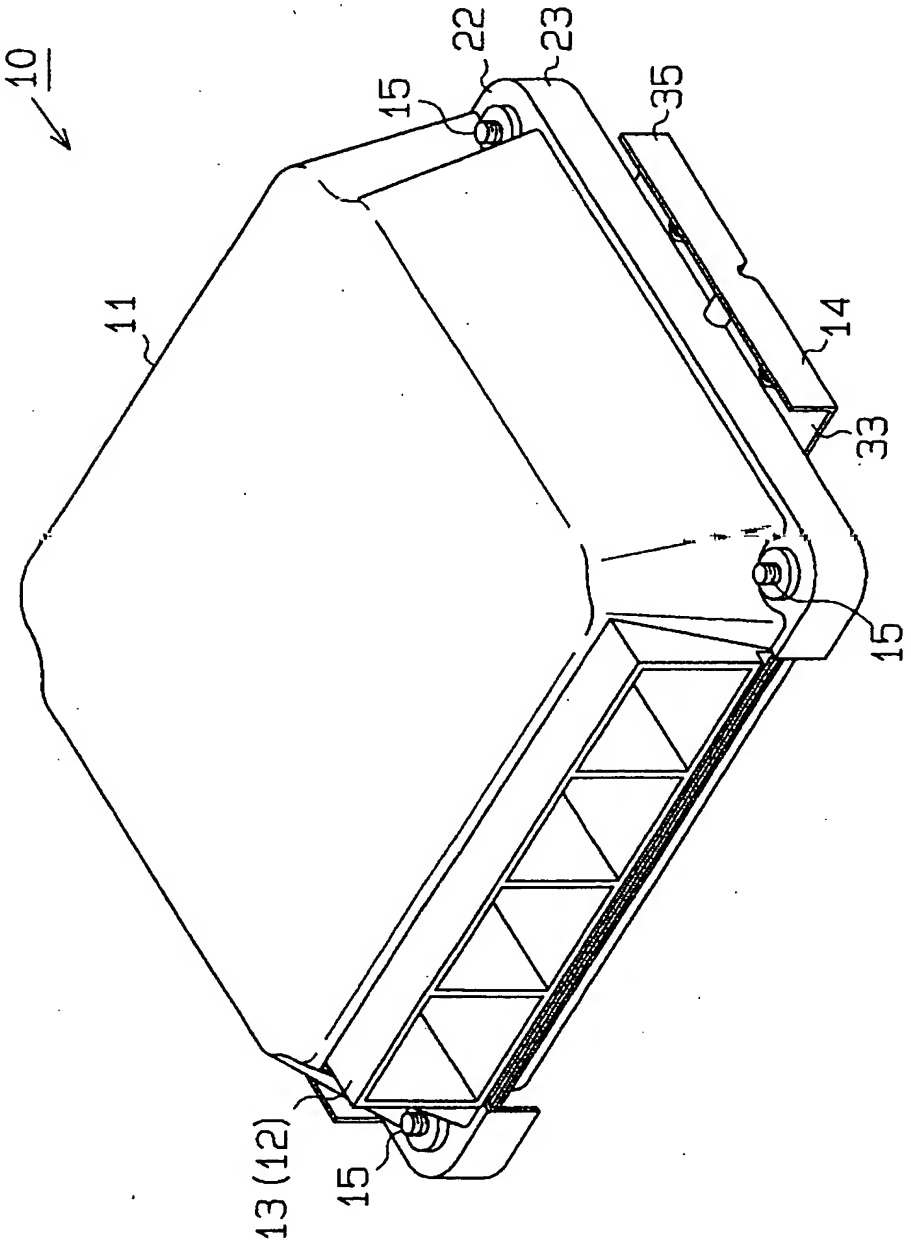
[Object] To prevent various types of inconvenience upon conveyance and improve productivity.

[Means of Solution] An ECU 10 has a case 11 in which a bottom surface opens, a circuit board 13 with which a connector 12 is integrated, and an approximately plate-shaped cover 14 to close the opening of the case 11. The cover 14 has a bottom plate 31 and a pedestal 32 provided on the periphery of the bottom plate 31. A pair of stays 33 projecting outside from the case 11 are integrally formed with the cover 14, and the stays 33 are provided with mounting holes 34 for mounting a bracket (not shown). Further, the end of the stay 33 is bent thus a bent portion 35 is formed. By providing the bent portion 35, when the ECUs 10 are arrayed and conveyed on a conveyer passage in an automated assembly line, overlap between the stays 33 of adjacent ECUs 10 can be prevented.

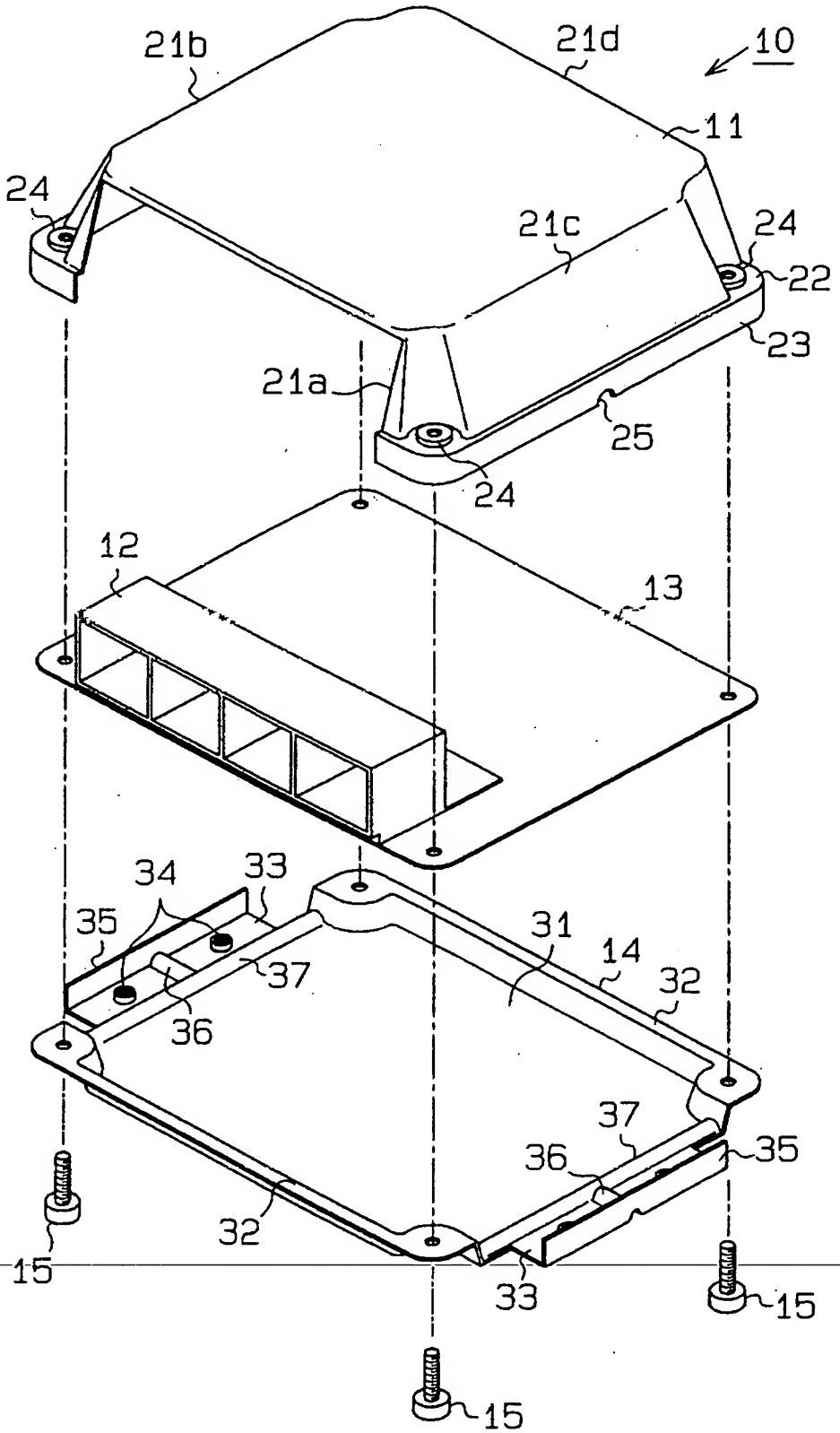
[Selected Drawing] Fig. 2

【書類名】　図面　[Name of Document]　DRAWINGS

【図１】　[Fig. 1]



【図２】 [Fig. 2]


21b
21d
10
11
24
21c
24
22
23
21a
25
24
12
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34
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33
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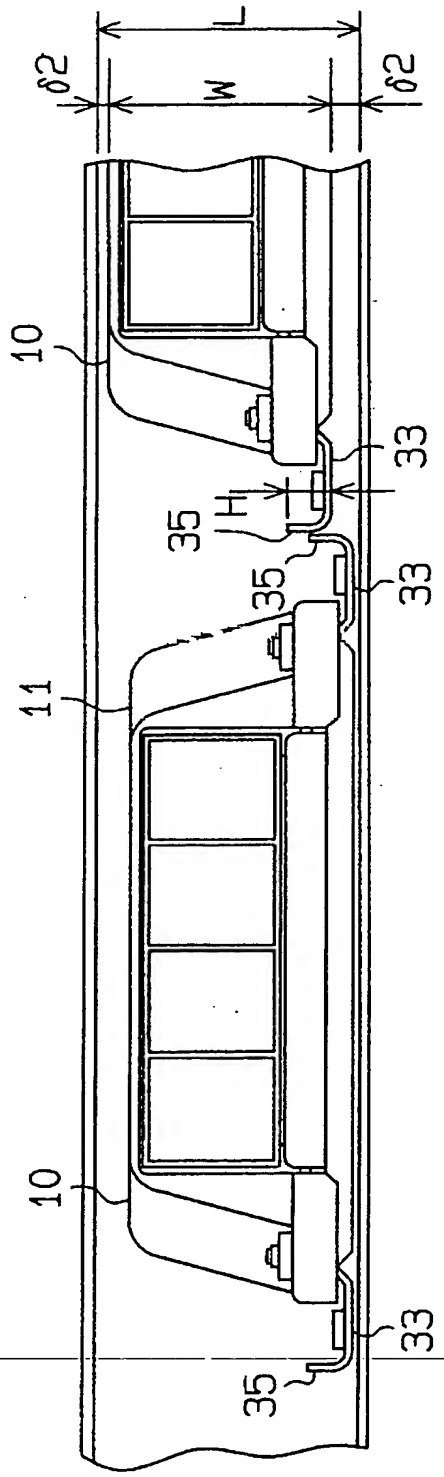
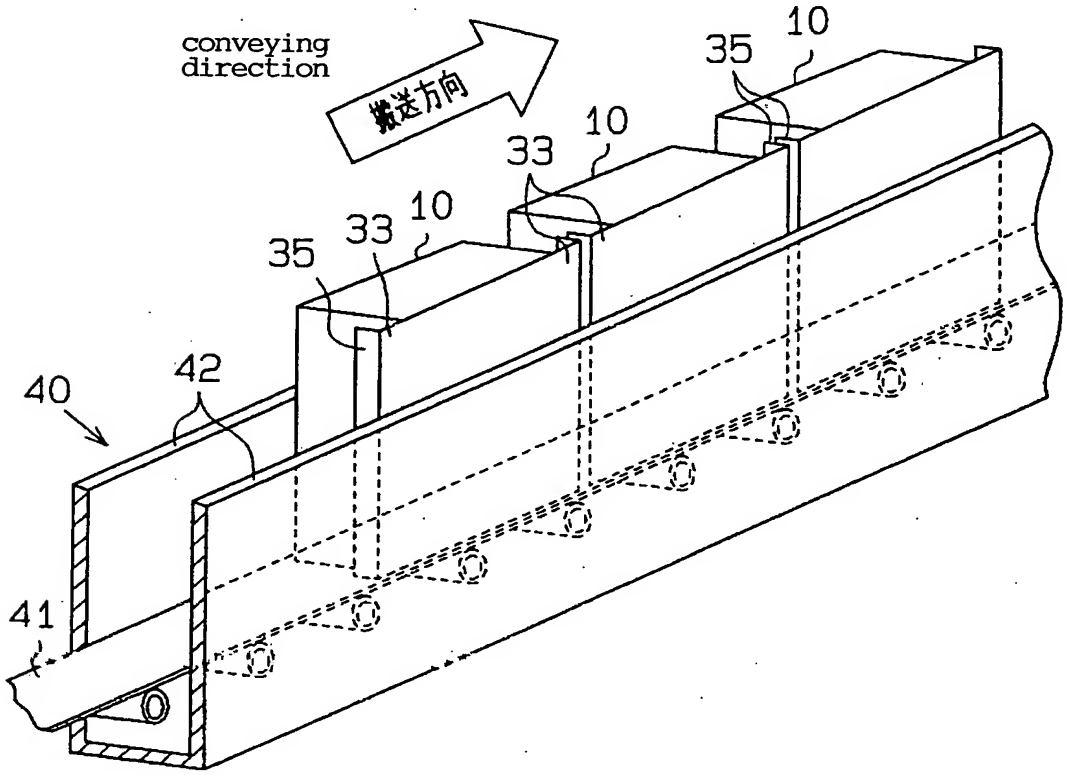
15

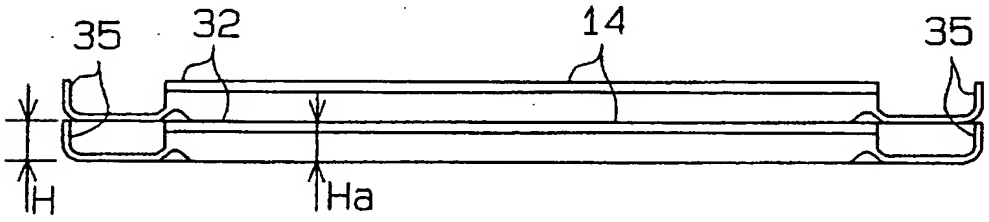
【図３】[Fig. 3]



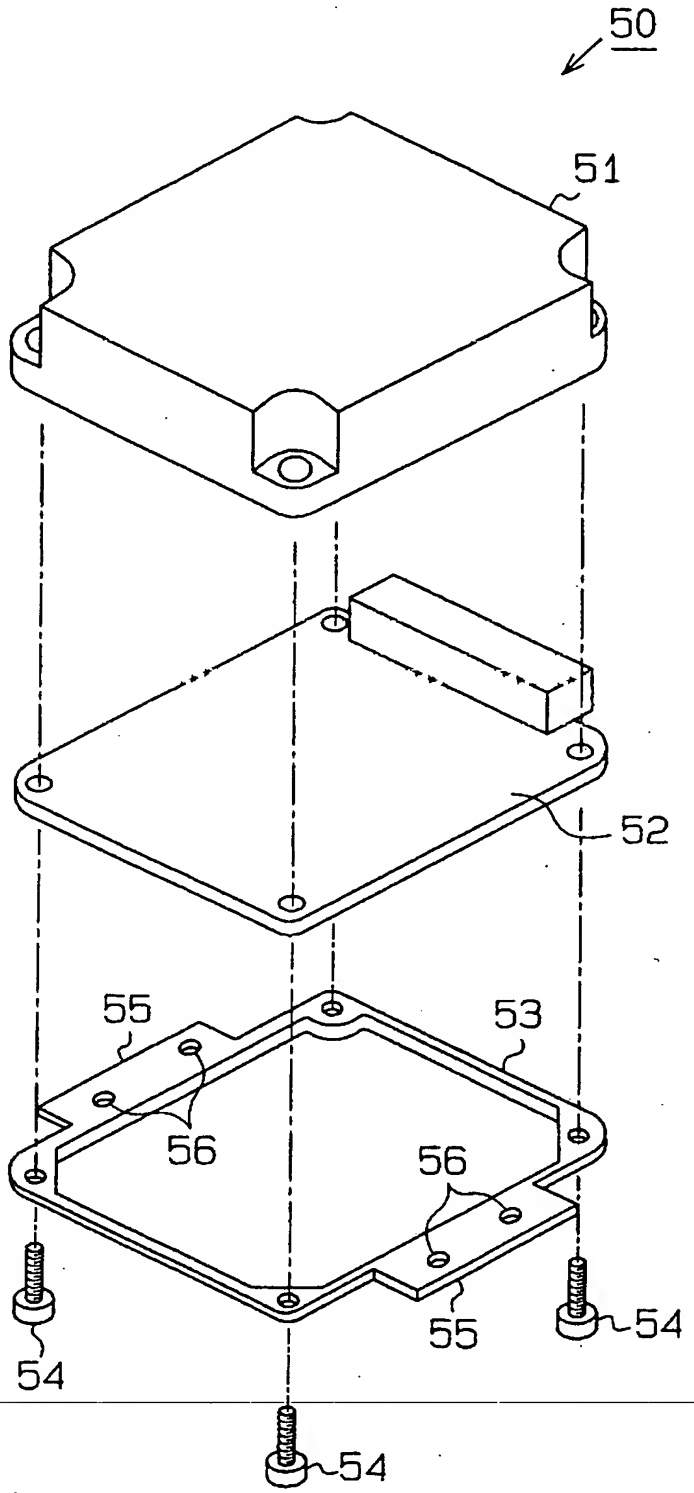
【図４】　[Fig. 4]



【図５】　[Fig. 5]



【図６】　[Fig. 6]



【図７】[Fig. 7]